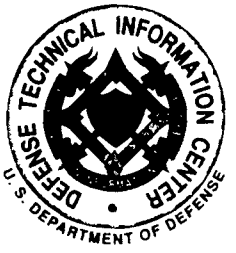

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EFFECTIVE MAGNETIC METHOD FOR DETECTING LONGITUDINAL CRACKS IN THE PIPES OF PIPE-LINE TRANSPORT

G.Shelihov,
Doctor, Scientific & Technical Centre "EXPERT",
140003, Liubertsy-3, Moscov region, a/b 8, Russia
V.Usoshin,
142717, pos.Razvilka, Lenin.sky dst., Moscow region, Russia
V.Lozovsky,
Professor, Scientific & Technical Centre "EXPERT"
140003, Liubertsy-3, Moscow region, a/b 8, Russia
V.Rozov
Gazprom
117884, Moscow, Namiotkina 16, Russia

Abstract: The magnetic method based on sensing the magnetic field distribution in the vicinity of a defect with a special measuring device is intended for using in flaw-detector gears for intra-pipe inspection and allows detecting longitudinal cracks, corrosion affections on an external pipe surface. The instrument УПМД-1 has been developed which implements this method and features high noise immunity and tolerance for many external factors.

Key words: Magnetic method; longitudinal cracks; intra-pipe inspection

An analysis of break-downs of cross-country gas lines has shown that in many cases the cause of pipe-line damages in operation is the presence of longitudinal cracks arising due to high internal static stresses in pipe's material, corrosion affections and pressure fluctuations inside the pipe.

After originating the longitudinal cracks propagate for a long time. Critical size having been reached, the crack causes pipe-line break-down.

Existing systems of intra-pipe inspection give a principal possibility of detecting only cross cracks and corrosion affections. These systems are based on measuring tangential or tangential and normal field strength components at the internal pipe surface being checked. The sensor moving along the pipe crosses a cross crack and indicates the field distribution, usually the tangential component of field strength in the vicinity of the defect, according to which the record signal is produced. In some systems of flaw-detector gears this signal is compared with defect signals recorded in the course of prolonged operation and stored in computer library. Also, such systems do not allow longitudinal cracks to be detected because the sensor of the moving flaw-detector gear travels along the crack. So the sensor signal carries insufficient information about the field distribution over a defect.

What is more, as the flaw-detector gear moves the gaps

between the sensor and pipe surface vary, which leads to changing signal amplitude. Disturbances can result from surface irregularities, various ferromagnetic impurities (generated in mounting the pipe-line), variations in gaps between the pipe and magnetizing system, discontinuities in magnetic properties of pipe's material. These as well as other inferring factors decrease the sensibility of a flaw-detecting system and hamper enhancing the detection signal, especially when its amplitude is well in excess of a noise level.

Because of this there is a need for a different way to solve the problem of detecting longitudinal cracks, the alternative method of magnetic inspection.

The foundation of the method developed for this purpose is an original principle of acquiring information and processing signals which consists in the fact that according to the information obtained from the measuring device a vector field is automatically constructed and a field pattern, that is, the distributiom of magnetic lines of force is determined. This makes it possible to obtain sufficient amount of characteristic parameters of the field in the vicinity of a defect which are directly associated with defect parameters. The quantitative values of these parameters give a complex of criteria for screening in accordance with technical specifications.

On this basis the instrument УПМД-1 was developed which includes matching device, electronic scanner system, microprocessor, and output device for storing information obtained. The instrument УПМД-1 features high noise immunity and allows reaching higher sensibility as compared to existing systems.

For example, variations in the gaps between the measuring element and the pipe surface under check do not influence substantially the inspection results because in this case of significance are not absolute signal magnitudes but their relative values. The field pattern constructed according to signals from the measuring element with different gaps are similar.

Random electric and magnetic noise also does not substantially affect the inspection results, it is easily filtered owing to being significantly different from detection signals (synthesis of random signal does not influence the standard field).The instrument УПМД-1 has a wide range of measurable fields. This allows solving a number of other problems with the use of specially designed sensors, for example, in determining the regions with elevated levels of internal stresses in pipe's material.

A pilot sample of the instrument has been fabricated which is now undergoing laboratory tasts.